中國文化大學 九十五 學年度 第二學期 期中 考試試卷					
考試科目	任課老師	系級	考試日期	份數	備註
應力	陳為仁	機一 A	96/04/19	70	可用計算機

1. Given: A car moves in a straight line such that for a short time its velocity is defined by $v = (9t^2 + 2t)$ m/s, where t is in second. When t = 0, s = 0. (15)

   Find: (1) Its position and acceleration when t = 3 s.
   (2) The average velocity and average acceleration during the 3-s time interval.

2. Given: At any instant the horizontal position of the weather balloon in Fig. 1 is defined by x = (9t) m where t is in second. If the equation of the path of the balloon is $y = x^2/30$. (15)

   Find: (1) The position vector of the balloon in rectangular components.
   (2) The velocity vector of the balloon in rectangular components.
   (3) The acceleration vector of the balloon in rectangular components.

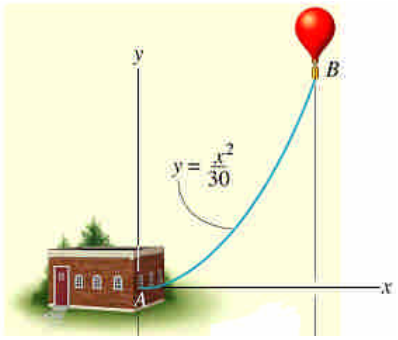

Fig. 1

3. Given: Measurements of a shot recorded on a videotape during a basketball game are shown in Fig. 2. The ball passed through the hoop even though it barely cleared the hands of the player B. Neglect the size of the ball. (20)

   Find: (1) The magnitude v_A of the initial velocity of the ball.
   (2) The height h of the ball when it passes over player B.

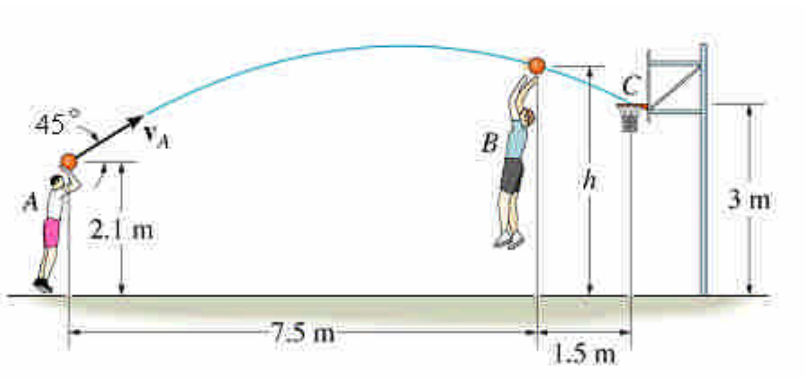

Fig. 2

中國文化大學 九十五 學年度 第二學期 期中 考試試卷					
考試科目	任課老師	系級	考試日期	份數	備註
應力	陳為仁	機一 A	96/04/19	70	可用計算機

4. Given: The motorcyclist starts his motorcycle from rest at point A as shown in Fig. 3, and increases his speed along the vertical circular path at the rate of $\dot{v} = (0.2t)\ \text{m/s}^2$, where t is in seconds. (Hint: Use normal and tangential components to describe the motion.) (15)

   Find: The magnitude of his velocity and acceleration when he reaches point B.

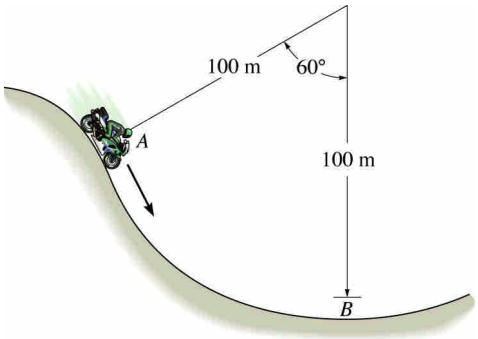

Fig. 3

5. Given: A smooth 2-kg collar C shown in Fig. 4 is attached to a spring having a stiffness k = 3 N/m and unstretched length of 0.75 m. If the collar C is released from rest at A. (20)

   (1) Draw the free body diagram and kinetic diagram of the collar C when it reaches the arbitrary position y.
   (2) Write down the equations of motion when the collar C is at the position y.
   (3) Determine the collar's acceleration and the normal force of the rod on the collar at the instant y = 1 m.

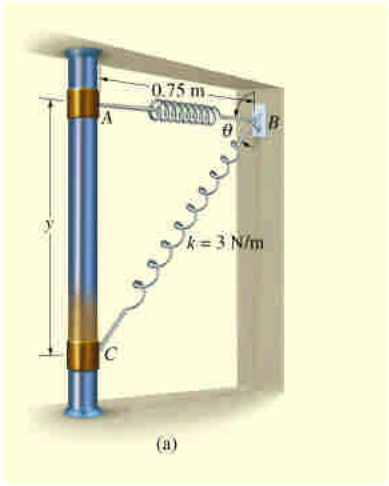

Fig. 5

6. Given: The 100-kg crate shown in Fig. 5 rests on a horizontal plane for which the coefficient of kinetic friction is $\mu_k = 0.25$. The crate is subjected to a 400-N towing force as shown. (15)

   Find: The velocity of the crate in 3 s if the crate starts from rest.

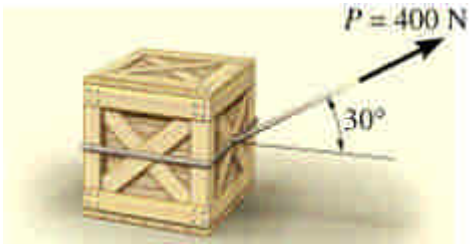

Fig. 5